



## Energy Storage Enabled Renewable MicroGrid Power Network



Pier Funding: **\$979K (35%)**------(Total Project Costs: **\$2,819K**)

Technology demonstrated: **Integration of wind, hydro & DG in MicroGrid  
using ultracapacitors**

Utility: **SCE**

Prime Contractor: **Palmdale Water District**

End Customer: **Palmdale Water District**

How does project work:

- Project integrates a 950kW wind turbine, 250 kW hydro and 250kW natural gas generator into a MicroGrid using 450kW ultra-capacitor energy bridge Ultracapacitor energy storage technology is used as an energy bridge to enable the smooth transfer of renewables and DG technologies.

Project Impact:

- Enable the growth of DG, renewables and MicroGrids
- Apply energy storage as enabling technology
- Provide critical missing link for renewable & DG integration

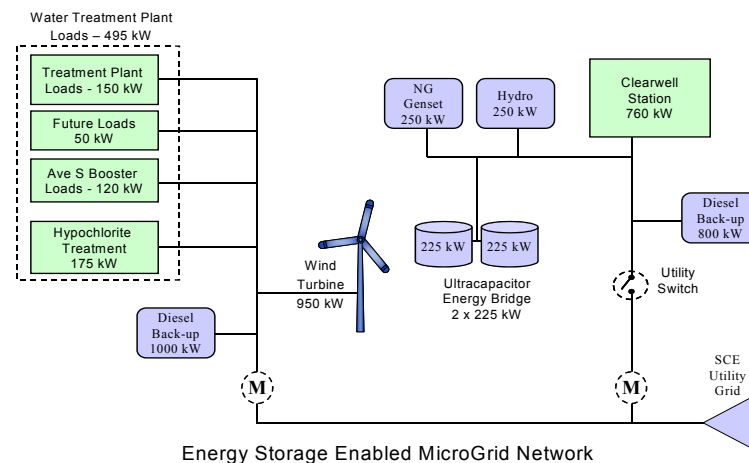
End User Benefits

- Reduced energy costs
- Improved system reliability
- Back-up power protection
- Improved power quality

Project Timeline:

- Start: February 2005
- Commission: June 2006
- Field Trial: 6/2006 – 12/2007

### Clearwell Proposal





## Demonstration of ZBB Energy Storage System



- Pier Funding: **\$1,873K** (75%)-----Total Project Costs: **\$2,476K**
- Technology demonstrated: **Zinc-Bromine battery storage for substation upgrade deferral**
- Utility: **PG&E** Prime Contractor: **ZBB Energy Corporation**
- End Customer: PG&E
- How does project work:

Project will demonstrate the value of using energy storage to improve T&D Congestion conditions and defer T&D upgrades. A transportable 2MW/2MWH ZBB battery energy storage system will be installed at substation to demonstrate and assess value of T&D upgrade deferral.
- Project Impact:
  - T&D system reliability improvement
  - Demonstrate economic impact of applying energy storage to T&D congestion problem
- End User Benefits
  - Continue to use T&D resources without making system upgrade
  - Improved system reliability
  - Improved system flexibility
- Project Timeline:
  - Start: April 2004
  - Commission: October 2005
  - Field Trial: 10/2005 – 9/2007





## Flywheel Energy Storage System (FESS) for Grid Frequency Regulation



- \* Pier Funding: **\$1,233K (78%)**------(Total Project Costs: \$1,580K)
- \* Technology demonstrated: **Flywheel Energy Storage for Response to ISO Grid Frequency Regulation Control (Demonstration Level Scale)**
- \* Utility: **PG&E** Prime Contractor: **Beacon Power Corporation dba Beacon Matrix Services**
- \* End Customer: CA ISO (Demonstration at the DUIT facility in San Ramon)
- \* How does project work:

Project will demonstrate the operation of a matrix of 7 separate flywheels integrated into a 100KW FESS with 15 minutes of electric storage capacity. Control System will monitor and respond to California Grid signals provided by the ISO. The project will provide a proof of concept level demonstration that, if successful, can be sized up to a utility level FESS Grid Frequency Regulation System
- \* Project Impact:
  - Demonstrate Grid frequency regulation at a scaled down version
  - Demonstrate the ability to receive and respond to ISO signals
  - Demonstrate capabilities of multiple flywheel matrix systems
  - Potential for use by several other ISOs throughout the US
- \* End User Benefits
  - Stabilize grid system frequency
  - Provide voltage regulation
  - Provide additional reactive power
- \* Project Timeline:
  - Start: January 2005
  - Commission: October 2005
  - Field Trial: 10/2005 – 5/2006

